

## IV. Wetland Status and Trends, Settlement to 1992

Although it is now commonly accepted that wetlands provide valuable environmental benefits, they were converted to other uses, altering and degrading wetland functions and values from the earliest colonial times. Wetlands were considered a health hazard, due to diseases such as yellow fever and malaria, a hindrance to settlement and land development, and a nuisance that needed to be eliminated (Wallace, 1985). Farmers recognized that many such "nuisances" were potential blessings in disguise, transforming over 28 million acres of wetlands into high-quality cropland in nine Midwestern States since settlement (Heimlich and Gadsby, 1994, p. 35). This chapter reviews historical and recent trends in wetland conversion and concludes with the status of the remaining wetland base.

### Trends in Wetland Conversion

Discerning trends in wetland conversion is difficult because different agencies, using different definitions and methods, collect data useful for examining broad trends. Moreover, these data have only recently become available for dates beyond the mid-1970's. Improvements in data collection methods result in wetlands inventoried at the beginning of a succeeding inventory exceeding wetlands inventoried at the end of a previous inventory. A naive reading of these data can lead to the conclusion that wetland extent had actually *increased*; in reality, the adjusted estimates reveal that wetland conversion continued from a previously underestimated base. Rather than simply reporting published trend data from other agencies, we constructed a single, relatively consistent series proceeding backwards from, or controlled by, the total wetland acreage found in the most recent inventories, but preserving the wetland losses and gains found within each multi-period inventory. Ranges of estimates reflect differences in wetland extent between two recent inventories (Fish and Wildlife Service, National Wetland Status and Trends Analyses and USDA, National Resources Inventories). We summarize the findings here. Our methods and detailed tables are contained in Appendix II.<sup>4</sup>

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<sup>4</sup>This data series does not include an inventory for 1985-95 reported after this manuscript was prepared for publication (see box: "Problems with Recent Wetland Status and Trends, pg. 23"). Differences in methodology between this latest inventory and others make comparisons questionable and could not be resolved prior to publication.

### Original Wetland Extent

When colonists first set foot in America, there were 221-224 million acres of wetlands in what was to become the continental United States (Dahl, 1990). (There were another 170 million acres in Alaska and Hawaii, but this report focuses on the lower 48 States.) Most of those wetlands were in three regions: the Midwestern States (27 percent), the Southeastern States (24 percent), and the Delta and Gulf States (24 percent) (see fig. 3). As settlement spread, wetlands were converted for other uses, with the pace increasing as available nonwetlands decreased and drainage technology improved.

### Agricultural Wetland Conversion

Most wetland conversion in the 19th century was originally done for agricultural purposes, although converted land subsequently was often used for urban development. Net rates of wetland conversion dropped from more than 800,000 acres per year between settlement and 1954 to less than 80,000 acres per year in 1982-92. Agriculture's share of gross conversion dropped from more than 80 percent in 1954-74 to 20 percent in 1982-92, while urban development's share rose from 8 percent to 57 percent (table 2). This long-term reduction in wetland conversion for agriculture coincided both with changing economic conditions that were less favorable for conversion and with enactment of Federal and State wetland regulatory programs (see Chapter V).

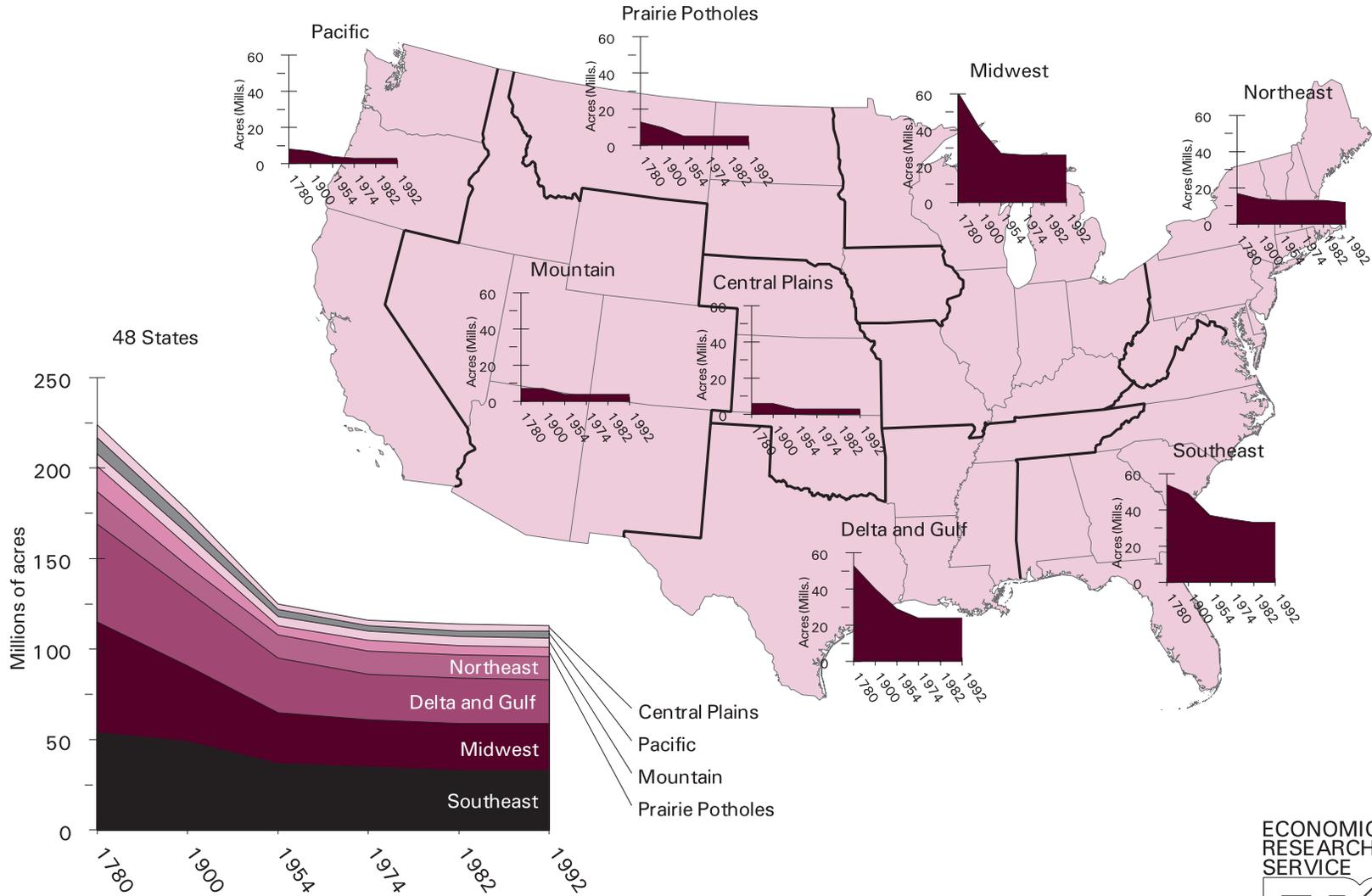
### Wetland Exploitation: Settlement to 1954

Between first settlement<sup>5</sup> and 1954, 40-44 percent of original wetlands were drained or filled. Data on land area drained (not all wetlands) show that most of this activity probably occurred after 1885, with as much as 50 million acres drained by 1920, few acres drained during the Depression and World War II, and another 25-30 million acres drained between 1945 and 1955 (Pavelis, 1987). With the explicit encouragement of Federal Government policies and local cooperative efforts, wetlands were converted to agricultural and other uses at an average net rate between 814,000 and 887,000 acres per year between settlement and 1954 (table 2). The highest rates of conversion occurred in the Midwest, Delta, and Southeast wetland regions,

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<sup>5</sup>Defined here as the date each State joined the Union.

Figure 3  
**Wetlands remaining, by year and wetland region, 1780 - 1992**



Source: USDA, ERS, based on FWS Status and Trends data and 1992 Natural Resources Inventory data.



**Table 2—Average annual wetland conversion, contiguous States, settlement to 1992**

Item	Average annual change in wetland acreage							
	Settlement-1954		1954-74		1974-82		1982-92	
	Thousand acres/year	Percent	Thousand acres/year	Percent	Thousand acres/year	Percent	Thousand acres/year	Percent
Wetlands converted to:								
Agriculture	na	na	593	81	235	53	31	20
Urban development	na	na	54	8	14	3	89	57
Other	na	na	35	5	168	38	16	10
Deepwater	na	na	48	6	29	6	20	13
Total	na	na	730	100	446	100	156	100
Converted to wetlands from:								
Agriculture	na	na	2,48 <sup>1</sup>	91	82	53	42	54
Urban development	na	na			0	0	1	2
Other	na	na			53	34	29	38
Deepwater	na	na	25	9	20	13	5	6
Total	na	na	272	100	156	100	77	100
Net change in wetlands <sup>2</sup>								
Agriculture	na	na	4,35 <sup>1</sup>	95	153	53	-11	-14
Urban development	na	na			14	5	87	110
Other	na	na			115	40	-12	-16
Deepwater	na	na	23	5	9	2	15	20
Total	814-887	100	458	100	290	100	79	100

na = not available.

<sup>1</sup>Conversion from agriculture, urban development, and other uses and net conversion not available as individual categories.

<sup>2</sup>Conversion of wetland to nonwetland uses, plus increases in wetlands due to restoration, abandonment, and flooding.

Source: Economic Research Service compilation of sources, including Dahl (1990); U.S. Department of the Interior, U.S. Fish and Wildlife Service, National Wetland Status and Trends Analysis, mid-1950's to mid-1970's and mid-1970's to mid-1980's, excluding Alaska and Hawaii and deepwater habitats; Soil Conservation Service, USDA, National Resources Inventories, 1982 and 1992, excluding Alaska, Hawaii and Caribbean and estimated acreage of deepwater habitats. See Appendix II for methods.

mostly for increased agricultural production (fig. 3). Almost 30 percent of net wetland conversion during this period was in the Midwest, 22-24 percent in the Delta and Gulf region, and 14-16 percent in the Southeast. Data are insufficient to reveal gross changes from dryland to wetland, but some wetlands were probably restored or created as lands once converted were abandoned, drainage failed, and reservoirs or other impoundments saturated formerly dry land.

#### **Modern Wetland Conversion: 1954-74**

The pace of net wetland conversion in 1954-74 was about half that of the long-term rate since settlement, dropping from as much as 887,000 acres to an average of 458,000 acres per year. Gross conversion to agriculture averaged 593,000 acres per year, while urban development, conversion to other uses, and water impoundments increased the total to 730,000 acres of wetlands converted per year. Conversion of dryland and deep water to wetlands averaged 272,000 acres per year, about 1 acre restored for every 3 acres converted.

During this period, the geographic focus of drainage shifted from the Midwest to the Delta and Gulf region (53 percent of all net conversion) and the Southeast (30 percent). In the Delta, expansion for agricultural production in Louisiana, Mississippi, and Arkansas was probably the largest contributor to wetland conversion, although changes to coastal wetlands on the Louisiana Gulf coast were also significant. In the Southeast, both urban and agricultural expansion in Florida and North Carolina were contributors. Net wetland acreage increased slightly in the Central Plains, Prairie Potholes, and Northeast, due to farmers abandoning some agricultural land, increased rainfall expanding wetland area, and farmers developing ponds and reservoirs with fringes of wetlands.

#### **Wetland Policy Transition: 1974-82**

Federal policy changes, such as the Clean Water Act's Section 404 and Executive Order 11990, and State wetland laws began to reduce wetland conversion from 1974 to 1982. Net wetland conversion dropped by 37 percent, from 458,000 acres per year to

290,000, despite greater economic incentives for agricultural conversion provided by higher market prices. Gross conversion for agriculture dropped to 235,000 acres per year, but a large increase in conversions to other uses kept total gross conversion at 446,000 acres. Gross increases in wetlands also fell to 156,000 acres per year, with agricultural lands accounting for more than half. Wetland was converted primarily in the Southeast, which had more than 60 percent of net conversion, and the Delta and Gulf region, which had 30 percent. Three-fourths of Southeast conversions were North Carolina wetlands converted to agricultural land, while changes in coastal wetlands in Louisiana and agricultural conversion in Mississippi and Texas contributed to net changes in the Delta region.

### *"No Net Loss": 1982-92*

The Swampbuster provisions of the 1985 Food Security Act, more rigorous enforcement of Section 404 permitting, changes in preferential income tax treatment of conversion investments, and additional State wetland regulation, as well as falling agricultural prices, further reduced wetland conversion in 1982-92. Net wetland conversion dropped 72 percent to 79,000 acres per year. Gross conversion to agricultural uses was only 31,000 acres per year, amounting to only 20 percent of total gross conversion. The building boom of the 1980's may have increased urban conversion to 89,000 acres per year, or 57 percent of the total. The shift in proportion of wetland losses urbanized may be overstated since it seems so large relative to relatively constant proportions in earlier inventories. Differences in the "urban" category in National Wetland Status and Trends Analysis and National Resources Inventory may explain these differences (see Appendix II). Gross wetland increases also dropped to 77,000 acres per year, but the ratio of restored to converted acres increased from 1:3 to 1:2. More than half of wetland restored was from agricultural lands, while 38 percent was from "other" and 6 percent from deep water.

The Southeast again had more than half of the net conversion, but the Midwest had 22 percent, and the Northeast had 18 percent. Agricultural conversion in North Carolina dropped sharply, but conversion for urban development in Florida and the Northeast increased. There was a net gain in wetlands in the Prairie Pothole region, particularly Montana and South Dakota, and broadly across the Central Plains region, particularly Oklahoma.

By 1992, 45-50 percent of the original wetlands in the 48 States had been converted to other uses, with losses approaching 90 percent in Illinois, Indiana, Iowa, Missouri, and Ohio. The rate of wetland conversion dropped steadily from the mid-1950's on, to 10 percent of historic rates, and shifted away from agricultural uses to urban uses. These data show that, although the United States is still losing wetlands every year, we are moving toward the goal of "no net loss" of wetland acreage that has been Federal policy for the last 8 years.

### **Status of Wetlands**

The wetland resource base remaining in the United States is a product of past conversion trends, much of which can be discerned from soil and water features observed today. Of the 224 million acres of wetlands and former wetlands in the 48 States, the 1992 land use of 195 million acres can be determined because they are wetlands or are known to be on hydric soils formed under wet conditions (table 3). More than 83 million acres of land no longer classified as wetlands on hydric soil was probably converted from wetlands since settlement. Two-thirds of this land (55.4 million acres) was in crop production in 1992, and another 15 percent (12.4 million acres) was in pasture and range uses. Urban, transportation, and water uses that may be on converted wetlands cannot be determined because no soils information is available. In addition, land in all uses that was converted from wetlands not on hydric soils also cannot be identified.

As outlined above, hydric soils and hydrology are two of the three most important criteria defining wetlands. Most wetlands (94.6 million acres; at least 85 percent) are on hydric soils, but not all hydric soils are wetlands. Wetland hydrology also varies, with remaining wetlands ranging from almost 50 million acres (45 percent) that have no likelihood of flooding to 22 million acres (20 percent) that are expected to flood 1 year in 2 and remain inundated for more than 7 days (table 4). Flood frequency and duration are not available for 17 million acres, more than 15 percent of 1992 wetlands.

Of the 111.5 million acres of remaining non-Federal wetlands inventoried in the 1992 National Resources Inventory, more than half (61.1 million acres) are forested. Miscellaneous uses, mostly marshes, barrens, flats and other nonuse categories, account for another 17 percent (18.8 million acres), and crop and

pasture uses make up another 14 percent (18.5 million acres).

Nearly 12 million acres (10 percent) of remaining wetlands are not on hydric soils, mostly in forest cover. We estimate that 12.5 million acres of wetlands are on Federal land, mostly in natural cover types, such as forest, range, and water.

Private owners hold more than 82 percent (92 million acres) of the remaining non-Federal wetlands in the 48 States inventoried in the 1992 National Resources Inventory (table 5). State, county, and local governments own another 14.7 million acres (13 percent). In addition, the Federal Government controls an estimated 12.5 million acres of wetlands, only a fraction of

which are in the National Resources Inventory. Of the privately owned wetlands, 77.5 million acres (84 percent) are farmed and naturally farmed wetlands subject to the 1985 Food Security Act Swampbuster provisions. Forty-six percent of the 195 million acres of identifiable wetlands and former wetlands were converted to nonwetland, either before 1985 (PC) or after (CW). Another 13.7 million acres of wetlands (7 percent) are identified scientifically under the Fish and Wildlife Service's Cowardin classification, but are not considered wetlands for Food Security Act purposes. There is no reliable way to estimate the extent of wetlands subject to the Clean Water Act's Section 404 dredge and fill permits, although both Food Security Act and Cowardin wetlands are likely included.

**Table 3—Wetlands and former wetlands by land use, 1992**

1992 land use	Wetlands				Nonwetland	
	Hydric	Not hydric	Not known <sup>1</sup>	Subtotal	Hydric	Total
Thousand acres						
Cropland	9,080	1,471	0	10,551	55,424	65,975
Pastureland	6,629	1,357	0	7,986	6,452	14,438
Rangeland	6,159	1,605	0	7,764	5,995	13,759
Forest land	55,817	5,297	0	61,114	9,461	70,575
Miscellaneous	16,923	1,841	0	18,764	3,040	21,804
Urban	0	0	952	952	0	952
Rural transportation	0	0	559	559	0	559
Water	0	0	3,826	3,826	0	3,826
Federal	0	0	0	0	3,140	3,140
<b>Total</b>	<b>94,607</b>	<b>11,571</b>	<b>5,336</b>	<b>111,513</b>	<b>83,513</b>	<b>195,026</b>

<sup>1</sup>Soils information not known because of land cover.

Source: Economic Research Service compilation of 1992 National Resources Inventory data.

**Table 4—Wetlands by flooding frequency and duration, 1992**

Expected flooding frequency (chance of flooding in any year)	Average duration of inundation per flood					Total
	Not applicable	Very brief (< 2 days)	Brief (2 - 7 days)	Long (7 - 30 days)	Very long (> 30 days)	
None	Not likely	49,962	0	0	0	49,962
Rare	0-5%	7,041	0	0	0	7,041
Occasionally	5-50%	0	507	3,212	3,415	7,967
Frequently	>50%	9	2,151	5,257	13,235	29,638
Not recorded		16,906	0	0	0	16,906
<b>Total</b>		<b>73,918</b>	<b>2,658</b>	<b>8,469</b>	<b>16,650</b>	<b>111,513</b>

Source: Economic Research Service compilation of 1992 National Resources Inventory data.

**Table 5—Remaining wetlands by ownership and Food Security Act status, 1992**

Food Security Act status	Private	Municipal	County	State	Federal	Indian/tribal	Water	Total
Thousand acres								
Farmed wetlands (FW)	3,768	1	2	54	0	37	0	3,862
Wetlands (W)	73,702	277	1,869	11,012	0	873	13	87,746
Wetlands subtotal	77,470	278	1,870	11,066	0	910	13	91,608
Converted wetlands (CW)	160	0	2	0	0	0	0	162
Converted prior to 1985 (PC)	83,384	143	260	1,327	3,140	376	5	88,635
Former wetlands subtotal	83,544	143	262	1,327	3,140	376	5	88,797
Artificial wetlands (AW)	757	3	5	99	0	14	0	878
Non-Food Security Act wetlands	8,506	143	125	1,048	0	97	3,825	13,743
Total wetlands	91,985	428	2,013	12,229	0	1,021	3,838	111,513
Wetlands/former wetlands	170,277	567	2,262	13,539	3,140	1,397	3,843	195,026

Source: Economic Research Service compilation of 1992 National Resources Inventory data.

### **Problems with Recent Wetland Status and Trends**

According to a report released by the U.S. Fish and Wildlife Service in September 1997, U.S. wetland losses continued in the 1985-95 period, but at a rate 60 percent below that recorded in 1974-83 (Opheim, 1997). The report estimated that 100.9 million acres of wetlands remained in the conterminous United States. Ninety-five percent of the remaining wetlands were estimated to be inland freshwater wetlands, and 5 percent were coastal or estuarine wetlands. Freshwater forested wetlands made up the single largest category of remaining wetlands.

The rate of wetland losses between 1985 and 1995 was estimated to be 117,000 acres per year, 60 percent lower than the loss rate reported for the mid-1970's to mid-1980's. However, 79 percent of the lost wetlands were projected to have been converted to agricultural uses. Urban development and other types of land use were estimated to be responsible for 6 percent and 15 percent of losses, respectively. Although loss rates to agricultural uses in 1985-95 were estimated to be 93,900 acres per year, 40 percent less than the 156,600 acres per year estimated for 1974-83, the proportion of losses due to agriculture in this report is higher than that estimated using the 1982-92 National Resources Inventory data.

Like previous U.S. Fish and Wildlife Service analyses (Dahl and Johnson, 1991; Frayer, and others, 1983), this study was based on aerial photography of 3,726 four-square-mile plots chosen using a weighted, stratified random sample. For this study, 2,682 plots were analyzed using photography with dates ranging from 1981 to 1991. Mathematical projection was used to estimate (1) the total area of the sample plot in each wetland type in 1985 and 1995, and (2) the changes in wetland type area between these dates. The projection technique was used to estimate 1985-95 losses for 2,682 plots with photography dating up to 1991, and for the 1,044 plots for which only data from the mid-1970's to mid-1980's were available. The projection technique depends on a fairly constant rate of change between dates, and makes no adjustment for policy changes after the photography was taken. The use of projection from earlier photography in this inventory makes comparisons with former inventories difficult. Because policy changes in the late-1980's were not taken into account, particularly those related to agricultural losses, losses projected from earlier photography are not likely to be accurate. These methodological differences were not resolved in time to include the new inventory in the data presented in this publication. The National Resources Inventory will serve as the basis for a single inventory of wetland resources beginning in 2000 (*National Wetland Newsletter*, 1998).